



JPL's Approach for Helping Flight Project Managers Meet Today's Management Challenges

Charles J. Leising

**Meeting the Project Manager Challenge
UM University College Conference Center
College Park, MD**

March 30-31, 2004



Background and Environment



- Mid 90s
 - JPL faced decreasing NASA budgets, increasing cost pressures and competition
 - Explosion in number of small projects
 - Retirement of experienced personnel
- Adopted “soft projectization” and FBC
 - Project Mgrs empowered to pursue creative approaches for cutting costs
 - Threw out old tried and true procedures
- Mars failures
 - External review committees questioned “how we do business”
- Environment after the failures
 - Increased oversight
 - Continued pressure to reduce costs



Problem Statement



- How can we put rigor back into the process and still get more efficient as an institution?
- How can we help project managers succeed in this difficult environment?



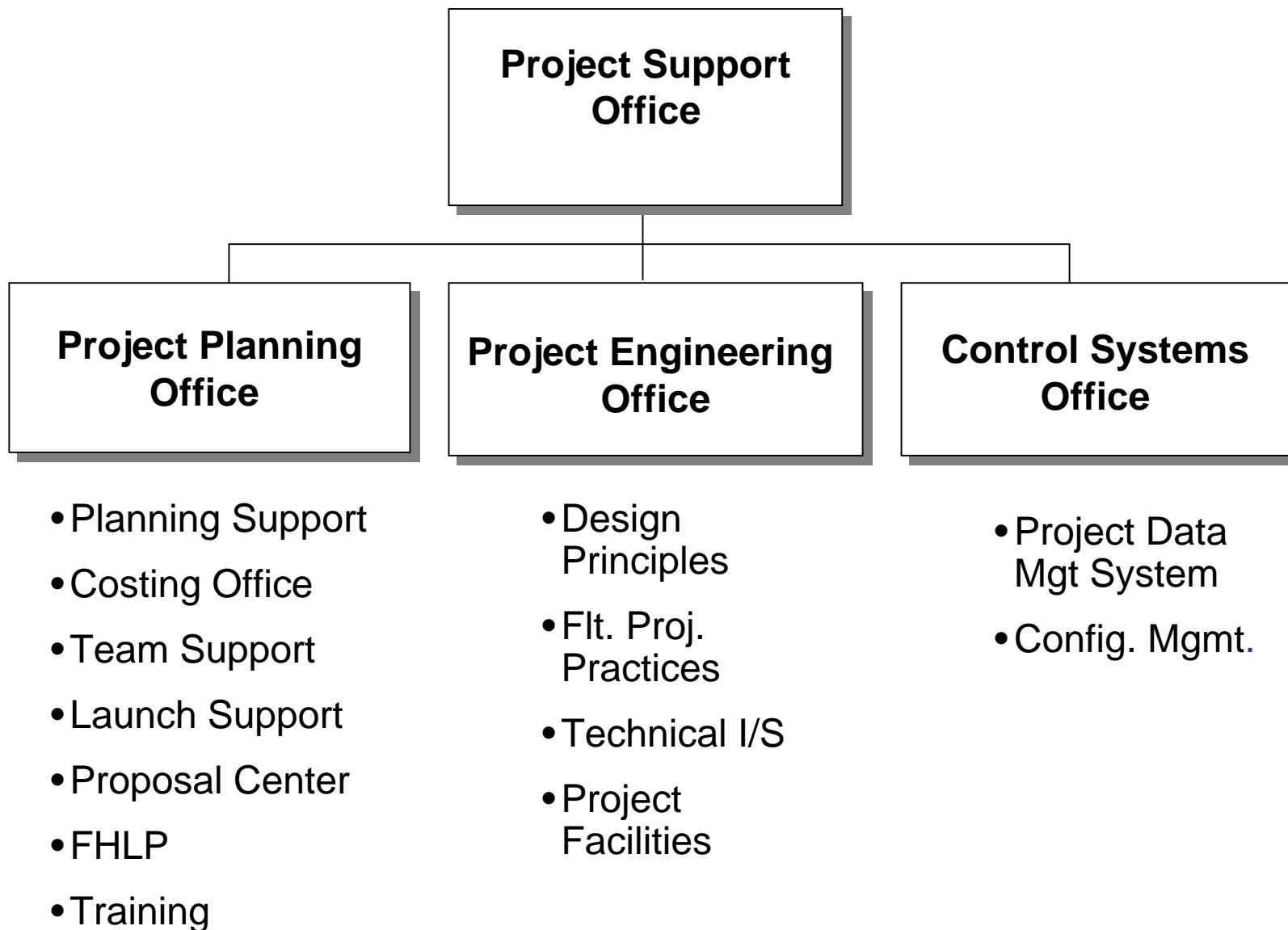
Approach



- Standardize the “routine” processes
 - New Flight Project Practices and Design Principles
 - New “standard” JPL lifecycle, gate products and WBS
 - Better coordinated review process
 - New project management training classes
 - Group procedures
- Increase the institutional support:
 - New position of Associate Director
 - New Project Support Office
 - Better partnering between line and projects
 - Mission design tools, cost databases, planning templates, examples and “project support” websites
 - Burden funded support teams



Organization





Institutional Guidelines



Design Principles:

- Covers mission, systems, hardware, software and operations
- Includes subsystem designs, margins, interface requirements, grounding, EMI and verification

Flight Project Practices:

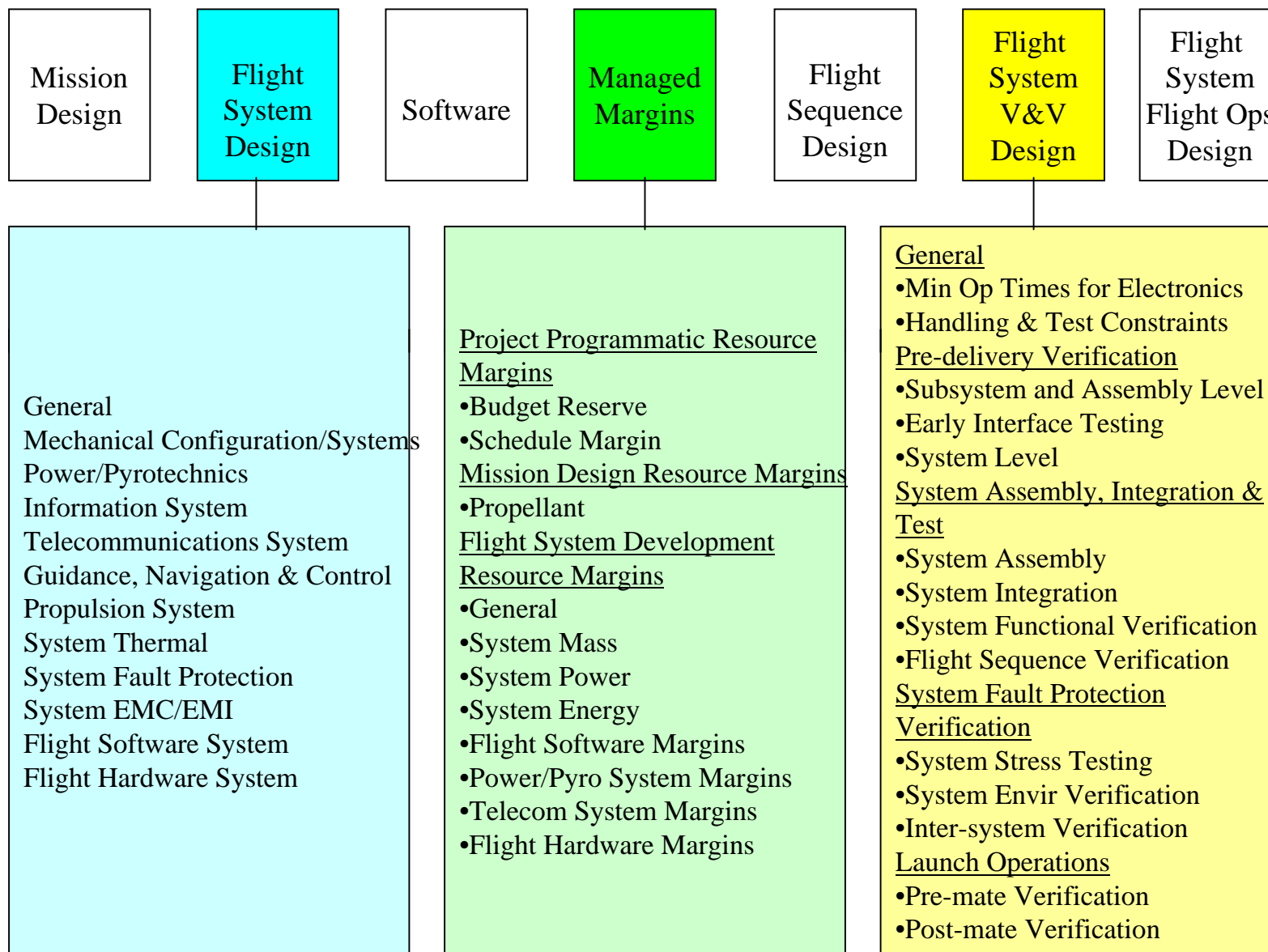
- Top level implementation practices
- 23 management, 18 engineering and 8 mission assurance

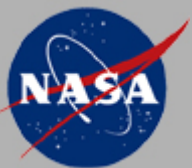
Compliance:

- Compliance matrices document compliance
- Attached to Implementation Plan
- Deviations must be justified and approved



Design Principles





Flight Project Practices



Management Practices

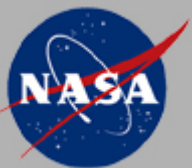
Life Cycle
WBS and Planning
Science
Organization
NEPA & Launch Approval
Spares, Testbeds, and Models
Make-or-Buy Decisions
Scheduling, Cost Estimating, Etc
Information Mgt
Level 1 Descope Planning
Project Staffing & Destaffing
Priorities/Competing Char
Acquisition
Reporting
Reviews
Risk Management
Waivers
Crisis Response
Science Data Management
Ext Comm & Public Engagement
Lessons Learned
Margins & Margin Mgt
ITAR

Engineering Practices

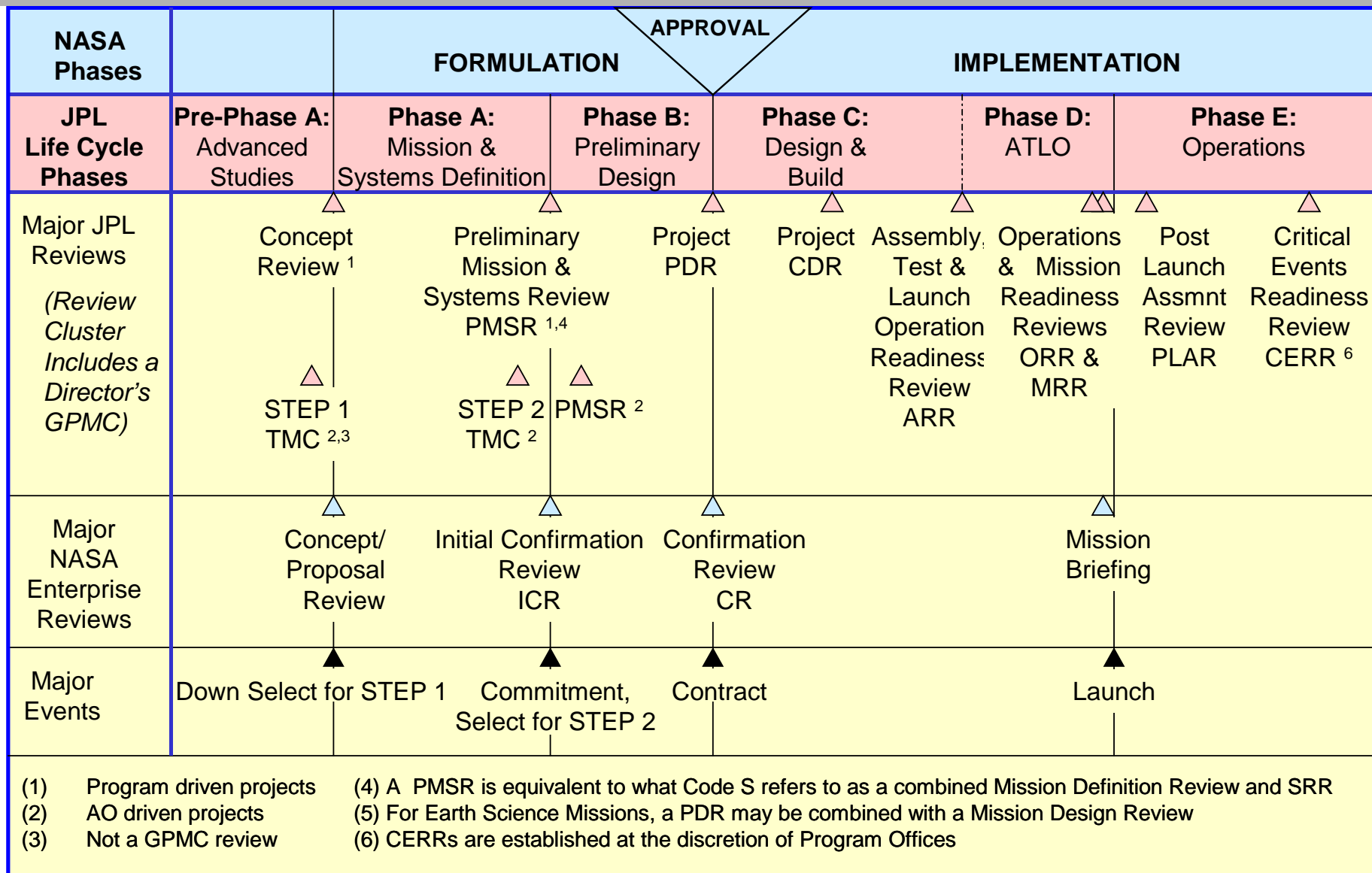
Mission Design
Telecommunications Design
Mission Operations
S.E.
L/V and Launch Operations
Inheritance
Planetary Protection
Fault Tolerance/Redundancy
Flight H/W Logistics
Materials, Processes, and
Contamination Control
S/W Devel
Protection and Security of Flt H/W
Design & Verification for
Environmental Compatibility
System Level Functional V&V
C. M.
Orbital Debris
H/W Development
Mission Ops System Devel

Mission Assurance Practices

M.A. Mgmt
Reliability Engineering
Q. A.
S/W IV&V
Electronic Parts Reliability,
Acquisition
Problem Reporting
Mission Operations Assurance
Systems Safety



JPL Project Lifecycle





- Documented over 100 products required at each Gate in the LifeCycle
 - planning
 - costing
 - technical
- Maturity at each Gate
 - draft, preliminary or final
- Used by projects and upper management:
 - planning
 - costing
 - scheduling
 - assessment
- Invoked by Flight Project Practices



Examples of Gate Products



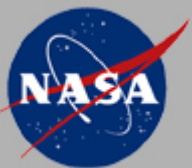
- Project plans
- Mission scenarios
- System requirements
- Cost estimates
- Flight designs
- Verification results
- Interface
documentation
- Command dictionaries
- Flight rules
- Etc



- Work breakdown structure and dictionary
- Plans
 - Task Plans (funding authority)
 - Project Plans responsive to FPP and NPG 7120.5
 - Detailed Project Implementation Plans, compliance matrices and work agreements
- Grass roots costing guidelines
- Documentation trees
- Requirements documentation
- Maintained in library accessible from website



- Multi-disciplinary team
 - 7 burden- funded, full time equivalents
 - Planning, work breakdown structures, cost estimation, earned value support, requirements definition, information system, software, acquisition
- Support projects
 - Institutional requirements
 - Templates, examples and process support during Formulation Phase
 - Time-critical problems
- Assures that projects get started on right path for successful implementation



Project Support Website





Jet Propulsion Laboratory
California Institute of Technology

[JPL HOME](#) [EARTH](#) [SOLAR SYSTEM](#) [STARS & GALAXIES](#) [TECHNOLOGY](#)

[HOME](#) [CENTERS & FACILITIES](#) [CONTACT](#) [SEARCH](#)

FLIGHT PROJECT:

- Status
- Reporting

PROJECT:

- Life Cycle
- Reviews
- Products
- Roles
- Processes

SUPPORT:

- Concept Development
- Proposal Development
 - Science
- Project Management
- System Engineering
- Mission Assurance
- Flight Engineering
- Software Engineering
- Mission Operations
- Launch System

[Policies & Requirements](#)

- [Compliance Matrices](#)
- [Examples & Templates](#)
- [Training & Education](#)
- [Support for New Projects](#)



Welcome to JPL's Project Support System!

This system contains information, resources, and references to assist project managers and team members working on Flight Projects. Throughout all phases of a project, this system supports Projects in meeting JPL and NASA life-cycle requirements for spacecraft, instrument or technology payloads. It provides access to document templates, tools and services to help "get the job done" effectively and to ensure a successful project.



 [Feedback](#)

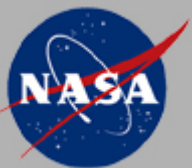
WHAT'S HOT ?

- ▶ [Preliminary Flight Projects Requirements Trace \(2/4/04\)](#) **NEW**
- ▶ [Mission Paradigms Presentation \(ppt\)](#) John Casani
- ▶ [Multiple Projects Calendar Presentation \(ppt\)](#) Pat Corcoran
- ▶ [Multiple Projects Calendar Training Package \(ppt\)](#) **NEW**
- ▶ [JPL Standard Flight Project WBS Template, Rev. 2 \(12/17/03\)](#)
- ▶ [Management Operations Working Group \(MOWG\) \(11/19/03\)](#)
 - [JPL Presentations](#)
 - [NASA Presentations](#)

FREQUENTLY ACCESSED DOCUMENTS

- ▶ [Flight Project Practices v5](#)
- ▶ [Flight Project Practice Compliance Matrix, Rev. 5 \(2/27/03\)](#)
- ▶ [Design Principles](#)
- ▶ [Design Principles Compliance Matrix](#)
- ▶ [Latest Monthly PSR Template \(ppt\)](#)

 [Cost Management Support](#)



Project Support Website - Life Cycle



FLIGHT PROJECT:

Status
Reporting

PROJECT:

Life Cycle
Reviews
Products
Roles
Processes

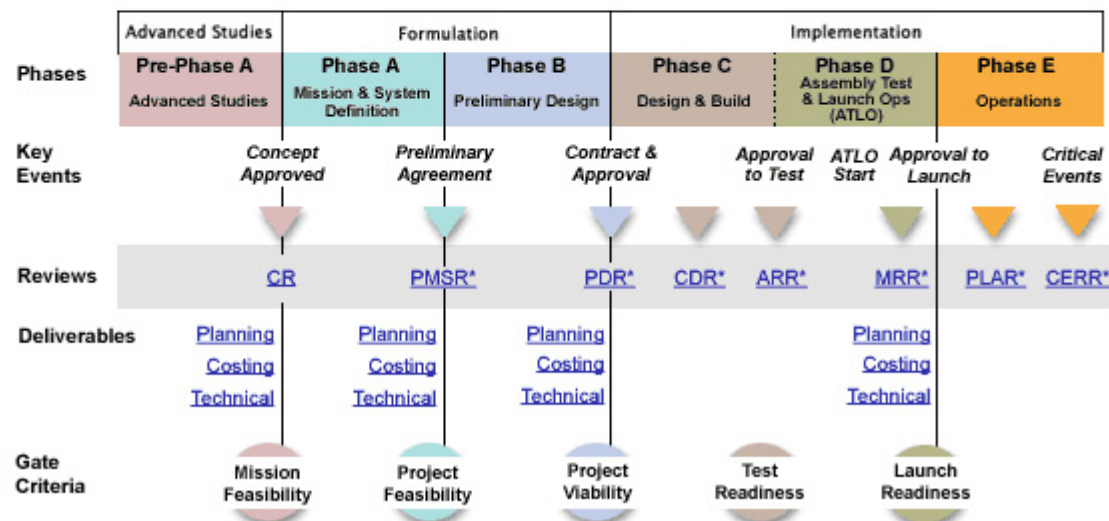
SUPPORT:

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Software Engineering
Mission Operations
Launch System

Flight Project Life Cycle

- [FPP Project Life Cycle](#)
- [Detailed Reviews](#)

04/02/03





Project Support Website - Reviews



FLIGHT PROJECT:

Status
Reporting

PROJECT:

Life Cycle
Reviews
Products
Roles
Processes

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[Admin Login](#)

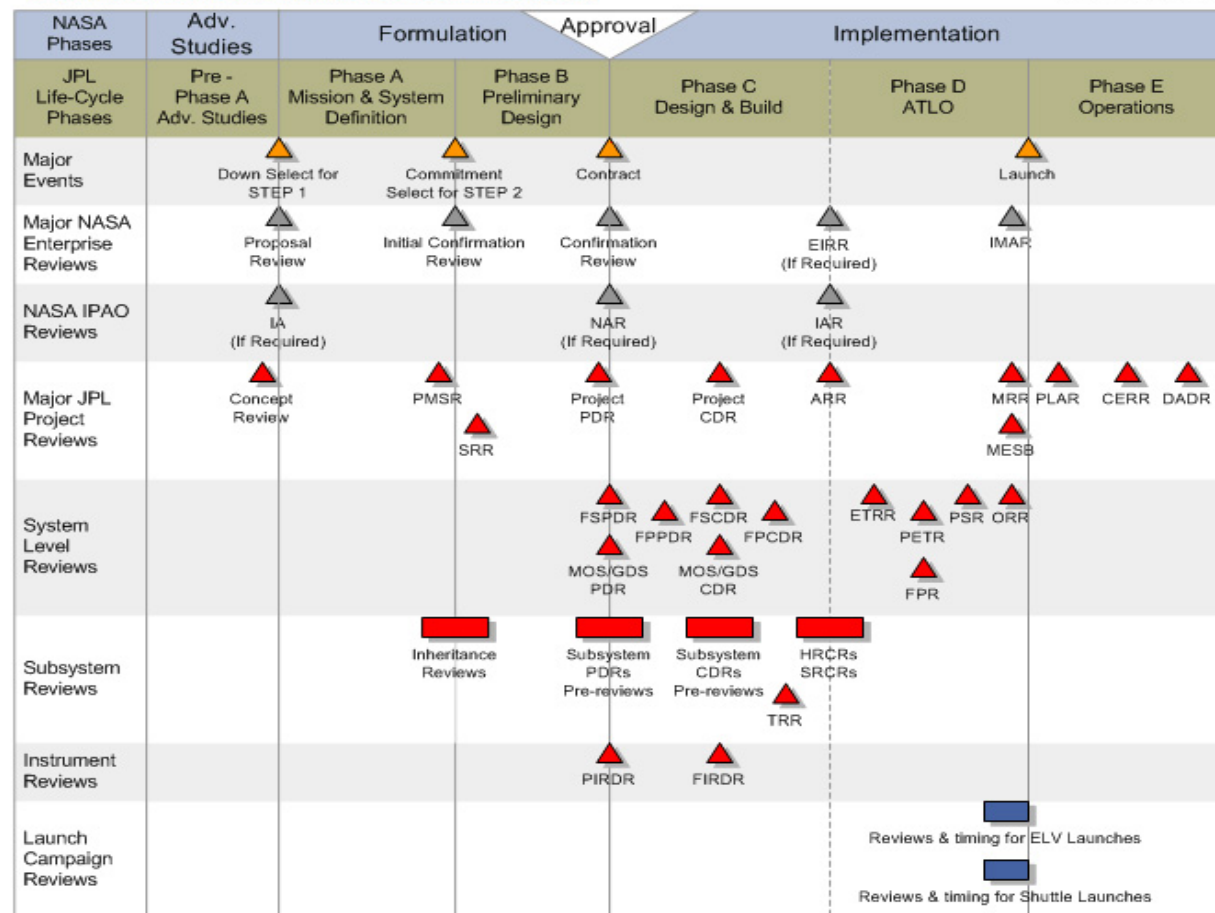
Project Life Cycle Reviews

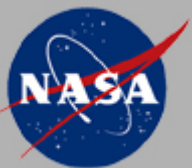
► [Project Reviews \(D-10401\), Rev. D](#) [Rules](#)

► [Project Review Plan Examples](#)

Updated: 9/16/2003

- Click on red triangles, red or blue blocks for more details.





Project Support Website - Review Descriptions



Preliminary Design Review- Project/Mission/Flight System

The PDR period is the time frame of transition, in the nomenclature of NASA 7120.5, from the Formulation process to the Implementation process. As such, it is a primary source of insight for assessment teams to allow the agency to confirm transition.) A hierarchy of PDRs is conducted, at the Project/ Mission, System and Subsystem level.

Note: Typically, the Project and Flight System level reviews are combined, while the Mission operations System review is held sometime later, as its design lags the Flight system, and hence it matures later, to the PDR level.

Objective:

The preliminary design review evaluates the project's readiness to proceed with implementation. This review evaluates the completeness and consistency of the planning, technical, and cost baselines--to the systems level, developed during formulation. It assesses the compliance of the design with applicable requirements.

Scope:

- a. Project level 1 requirements and mission success criteria
- b. Project description, plans and schedules, participants and roles and responsibilities
- c. Science objectives and payload description
- d. Project, mission, and science requirements completeness wrt mission objectives
- e. Requirements flow-down to level three (systems level), and draft flow-down to level four.
- e. Mission, system and subsystem designs including key trade-offs
- f. Technology developments
- g. Verification and validation approach
- h. Project risk management approach including the significant risks, mitigation options, and descopes
- i. Project lifecycle cost estimate including costing methodology and validation, budget reserves, and cost risk
- j. Open items and plans

Timing:

This review is held prior to the phase B-to-C/D transition, when the maturity of the planning, design, and costing allows the project to give credible presentations on the PDR topics

Success Criteria:

The review board is able to conclude that:

- a. The level 1 requirements and mission success criteria are reasonable, finalized, and stated clearly.
- b. The requirements flowdown is complete, and adequate understanding exists for the mission and system requirements.
- c. The mission and system designs comply with the requirements, contain adequate margins, and represent acceptable mission risk.
- d. The proposed management approach, including the plans and schedules, is sufficiently well defined.
- e. The technical and programmatic resources, including the staffing plan, schedule margin, and budget reserve, are adequate to complete the development with acceptable risk.
- f. The Project risks are understood, and adequate plans and a process exists for managing these risks.
- g. The Project state of readiness of the technical baseline and implementation approach is sufficiently mature, and adequate plans exist for the handling of the open items, such that a formal commitment can be made to the sponsor, and the Project proceed with the implementation.

Agenda Topics:

- a. Project
 1. Project description
 2. Level 1 requirements and assessment
 3. Key challenges and Project constraints
 4. Key Project policies (including single point failure policy)
 5. Mission success criteria
 6. Project organization chart and key staff status
 7. Project implementation mode
 8. Project schedule (including critical path) and margin
 9. Project deliverables and spares philosophy
 10. Significant changes/accomplishments since PMSR
 11. Status of PMSR action items
 12. Open issues/items and resolution plans and assessment
 13. Project summary status
 14. Program interfaces



Project Support Website - Project Management and System Engineering



	SUPPORT: Concept Development Proposal Development Science Project Management System Engineering Mission Assurance Flight Engineering Software Engineering Mission Operations Launch System	<input type="checkbox"/> Project Planning <input type="checkbox"/> Work Breakdown Structure <input type="checkbox"/> Cost Management <input type="checkbox"/> Schedule Management <input type="checkbox"/> Risk Management <input type="checkbox"/> Tech Transfer/Commercialization <input type="checkbox"/> Acquisition <input type="checkbox"/> Education & Public Outreach <input type="checkbox"/> Information Management <input type="checkbox"/> Information Services <input type="checkbox"/> International Affairs (ITAR/EAR)
SUPPORT: Concept Development Proposal Development Science Project Management System Engineering Mission Assurance Flight Engineering Software Engineering Mission Operations Launch System Policies & Requirements Compliance Matrices	Policies & Requirements Compliance Matrices Examples & Templates Training & Education Support for New Projects	<input type="checkbox"/> System Engineering <input type="checkbox"/> Requirements Management (DOORS) <input type="checkbox"/> Configuration Management <input type="checkbox"/> Launch Approval/NEPA <input type="checkbox"/> Launch System Integration <input type="checkbox"/> Mission Design & Navigation <input type="checkbox"/> Planetary Protection



Project Support Website - Flight Hardware Logistics Program



The screenshot shows the FHLP website in a Netscape browser window. The browser's address bar displays <http://fhlp.jpl.nasa.gov/>. The website header features the FHLP logo, the text "Flight Hardware Logistics Program", and links for "SITE MAP" and "COMMENTS". A left-hand navigation menu lists various sections: "Material Catalogs", "Mission List/Usage", "Related Links", "Program Library", "Process Material", "Registration Instructions - Lab Cleanup", "Login", and "Home". The main content area is titled "WHAT IS FHLP?" and contains several paragraphs of text explaining the program's purpose and goals. It also includes a section titled "WHAT'S IN THIS WEBSITE?" which provides links to the "FHLP Catalog", "Mission List", and "Program Library". At the bottom of the main content area, a comment directs users to contact the FHLP Manager, Kevin P. Clark.

WHAT IS FHLP?

The Flight Hardware Logistics Program (FHLP) is a program office created as part of JPL's Develop New Products (DNP) initiative to reduce lead-time associated with material used by flight projects. It performs this function by creating an inventory of flight hardware and providing information about this material to designers and projects.

The inventory consists of residual inventory from prior projects, inventory from ongoing procurements such as common buys, and inventory available through supplier agreements.

The general FHLP process is: 1) new proposals check with FHLP for material availability, 2) new projects design in residual inventory and common buy hardware, 3) current projects use material to build spacecraft, 4) launched projects register residual material for re-use.

WHAT'S IN THIS WEBSITE?

The purpose of this FHLP Website is to make information about flight material readily accessible for inclusion into spacecraft and instrument design. The catalogs list material readily available through JPL, industry, and other NASA centers and agencies as well as general product information (subsystem, past project, manufacturer, quantity available, records availability, size, weight, value, etc.).

The [FHLP Catalog](#) is an inventory of residual material from past flight projects available to JPL missions. This catalog is sorted by subsystem and has view, sort, report, and request (shopping cart) capability. Current block-buys of material among flight projects and pre-negotiated material/service contracts are included in the catalog.

The [Mission List](#) is FHLP's current listing of JPL projects with information on key contacts, PDR, CDR, and Launch dates. The Project Usage Database is a database of products being used or considered for use by FHLP customers (projects/missions) providing valuable information to projects and insight for FHLP to target its efforts.

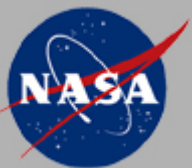
The [Program Library](#) includes FHLP programmatic information, product technical documentation, and related project information. The Process Material information includes links to the FHLP Charter, Policies, and Procedures.

Comments regarding this site should be directed to the FHLP Manager, [Kevin P. Clark](#)

SUPPORT:

Concept Development
Proposal Development
Science
Project Management
System Engineering
Mission Assurance
Flight Engineering
Software Engineering
Mission Operations
Launch System

- ☐ Hardware Development
- ☐ CAE Tool Service
- ☐ Standards
- ☒ Flight Hardware Logistics



JPL - Configuration Management Plan Generator

The CM Generator will generate a draft CM plan ([CM Plan definition](#)) in Word 97 within your browser. You can then save the draft to your machine and use it to complete a CM Plan for your project.

Follow these steps to generate your draft:

1. Enter the appropriate information in the form on this page. A draft outline will be generated.
2. Enter the appropriate information in the draft outline form. A draft Word file will be generated.
3. Save the Word file to your local disk; change the name of the file extension from *.exe to *.doc.

Enter the *Project Name* as you would like it to appear in the document:

Project1

(1) What type of project is it?
(please check all that apply)

- ☐ Spacecraft
- ☐ Instrument
- ☐ Ground System
- ☐ Software Development
- ☐ Prototype
- ☐ Science
- ☐ Technology Demonstration

(2) What is the nature of the project?
(please check all that apply)

- ☐ In-house development
- ☐ Commercial Team Partners
- ☐ Government Team Partners
- ☐ Subcontractors
- ☐ Universities

(3) What is the nature of development?
(please check all that apply)

	Software			Hardware		
	Flight	Test	Ground Support	Flight	Test	Ground Support
New	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heritage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Commercial off the shelf (COTS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modified off the shelf (MOTS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Government Furnished Equipment / Software (GFE/GFS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integration with externally developed / provided system elements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Configuration Mgt Plan Example



New Project Configuration Management Plan

PD xxxx-xx

Prepared By:

Name
Configuration Management Engineer

Date

Concurrence By:

Name
TBD Project Manager

Date

Name
TBD Flight System Manager

Date

Name
TBD Mission System Manager

Date

Henry F. Tauchen
JPL DNP Configuration Management Process Owner

Date

NATIONAL AERONAUTICS and
SPACE ADMINISTRATION



JET PROPULSION LABORATORY
California Institute of Technology
Pasadena, California

JPL D-yyywww

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Cost Risk Factors



- Mission Complexity
- Significant Technical Development
- New or Unvalidated Software Inheritance
- Technical Margins
- System Architecture
- Contractor Capabilities Match
- Programmatic/ Cost and Schedule Margin
- Management and Organization



Application of Risk Factors



- Subfactors identified to explain and quantify each factor
- Factors and subfactors identified as:
 - Primary
 - Secondary
- Allocation added for unknown- unknowns
- Correlation based on 13 most recent projects
- Validated through review and application to other projects
- Used as a tool for evaluating reserve posture on new proposals and projects



Project Manager Course



- Week-long offsite offered twice a year
- End-to-end overview of JPL Project Life Cycle
- Rules, lessons learned, where to get help
- Presentations, panel sessions, top management, NASA and contractor involvement
- Planning, costing, project control, system engineering, design, development, test and operations
- Assumes management skills and focuses on how to manage a project at JPL
- Required for all candidate project managers
- Highly rated and much in demand



Other Possible Applications



- NASA HQ
- NASA Centers
- Other FFRDCs
- Industry??



Summary



- Reliability and efficiency have been increased
- Changes in culture have taken 3 years
 - Everyone now knows what is expected
 - Couldn't have happened without active top management support
- Definition of rules in combination with more institutional help to project personnel has proven to be an excellent model
- Could be applied to HQ, other Centers and FFRDCs